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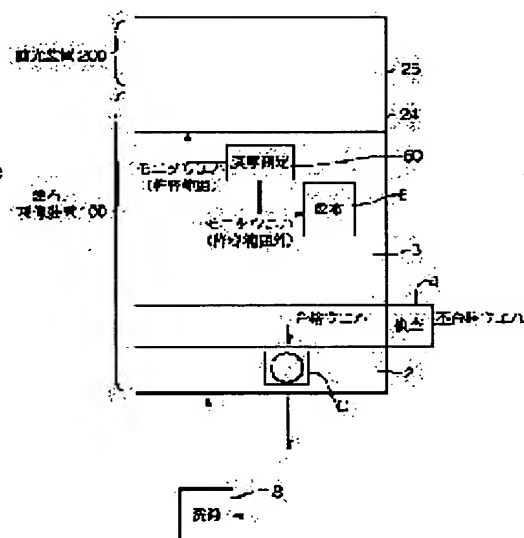
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(72)Inventor : OGATA KUNIE

**(54) APPLYING AND DEVELOPING APPARATUS AND SUBSTRATE RECYCLING SYSTEM IN APPLYING AND DEVELOPING PROCESS****(57)Abstract:**

**PROBLEM TO BE SOLVED:** To realize an applying and developing apparatus which can improve throughput and cope with automation, when it is put in operation to check a processed substrate or a monitoring substrate.

**SOLUTION:** A pattern check section 4, which checks a resist pattern and a carrier that houses wafers which are rejected by inspection are provided to the transfer region of a wafer transfer section which loads or unloads a carrier placed on a carrier loading/unloading section, the carrier is transferred to a cleaning station provided outside an apparatus, the resist is removed from a rejected wafer by cleaning for recycling the rejected wafer, and the rejected wafer is reloaded into the apparatus. The thickness of a resist film formed on a monitoring wafer is measured at a film thickness measuring part 50 provided inside the apparatus, and then the resist film is removed from the monitoring wafer by the use of a solvent nozzle for recycling the monitoring wafer.

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CLAIMS

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## [Claim(s)]

[Claim 1] In spreading and the developer which develop the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the development section, With the pattern Banking Inspection Department which inspects the resist pattern formed in the substrate after a development Spreading, the developer which are characterized by having a classification \*\*\*\*\* means from the substrate judged in the substrate judged in this pattern Banking Inspection Department to be a rejection to be success.

[Claim 2] They are spreading according to claim 1 which a conveyance means consists of the 1st conveyance section which delivers with said carrier and conveys a substrate between locations, and the 2nd conveyance section which conveys a substrate between said delivery location, the spreading section, and the development section, and is characterized by preparing the pattern Banking Inspection Department in the conveyance field of said 1st conveyance section, and a developer.

[Claim 3] A conveyance means is spreading according to claim 1 or 2 characterized by conveying the carrier which returned the substrate judged to be success to the carrier of a carrier carry in/out part, and was judged to be a rejection on said carrier for rejections, and a developer including the carrier for rejections with which a classification means contains a rejected substrate to dedication, and said conveyance means.

[Claim 4] A classification means is spreading according to claim 1 or 2 characterized by being a marking means to perform marking to a rejected substrate, and a developer.

[Claim 5] A classification means is spreading according to claim 1 or 2 characterized by a rejected substrate being the storage section which memorizes of which storing location of which carrier it is a substrate, and a developer.

[Claim 6] In spreading and the developer which develop the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the development section, Spreading, the developer which are characterized by having the thickness measurement section which measures the thickness of the resist film of the monitor substrate taken out from the monitor substrate stowage which contains a monitor substrate, and this monitor substrate stowage, and judges whether the resist film is suitable thickness.

[Claim 7] Spreading according to claim 6 characterized by for the solvent from the solvent nozzle in which it was prepared by the spreading section removing the resist film of the whole

front face of the monitor substrate which measured thickness in the thickness measurement section, and reproducing a substrate, a developer.

[Claim 8] Spreading according to claim 6 or 7 characterized by preparing the heating unit for performing pretreatment and/or after treatment to spreading processing and a development of a resist, and the cooling section which cools the substrate heated by this heating unit, arranging either [ at least ] a heating unit or the cooling sections to multistage, constituting a shelf, and using the stage of 1 of this shelf as the thickness measurement section, a developer.

[Claim 9] They are spreading of a publication, and a developer either to claim 1 characterized by to have a means judge for every substrate whether it is necessary to reproduce a substrate by removing the resist film on a substrate with reference to said processing hysteresis storage section or when the processing hysteresis storage section which memorizes the processing hysteresis of each substrate, and operation of equipment stop and processing is interrupted, and whether there is nothing thru/or 8.

[Claim 10] The substrate regeneration system in spreading and the development which reproduce a substrate and are characterized by returning the reproduced substrate to said spreading and a developer, and forming a resist pattern again by conveying the substrate judged in the pattern Banking Inspection Department to be a rejection in the washing section using spreading and the developer which were indicated by claim 1, washing a substrate here, and removing the resist film.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the system which regenerates that substrate, when the processing state of the substrate processed with spreading which forms the resist film in a substrate, develops negatives to the substrate after exposure and forms a desired pattern, a developer, and this equipment is not good.

[0002]

[Description of the Prior Art] In the manufacture process of a semiconductor device, resist liquid is applied to substrates, such as a semi-conductor wafer, the resist film is exposed using a photo mask, and the photolithography technique which produces on a substrate the resist mask which has a desired pattern is used by developing it.

[0003] This photolithography is performed by the system which connected aligner 1B to spreading developer 1A as shown in the schematic diagram of drawing 10 . if the case where a semi-conductor wafer (henceforth a wafer) is processed is taken for an example, spreading developer 1A will become the carry in/out part 11 which carries out carrying-in appearance of the wafer carrier C, and the delivery arm 12 which picks out a wafer from the carrier C laid in this carry in/out part 11 from spreading, the development section 13, and the interface section 14, and will be connected to aligner 1B. The resist film is formed, the wafer W carried in to the spreading development section 13 through the delivery arm 12 is exposed in aligner 1B, and a development is returned and carried out after that to spreading and the development section 13, and it is returned to Carrier C through the delivery arm 12.

[0004] If the wafer W which finished processing is contained by Carrier C, Carrier C will be taken out by an operator or the automatic carrier robot from a carry in/out part 11, and will be conveyed by the inspection unit 15 with him. In this inspection unit 15, it inspects about spreading nonuniformity, a development defect, etc. of the line breadth of the resist pattern formed on Wafer W, the lap condition of a resist pattern and a substrate pattern, and a resist. And although the wafer W judged to be success is sent to degree process, the wafer W judged to be a rejection is sent to the washing unit 16. The device formed on Wafer W is making multilayer structure, although one device is created, since it passes along a spreading development system also dozens times, in the washing unit 16, using the drug solution according to each phase, it is immersed in Wafer W into the drug solution, carries out dissolution removal of the resist, and returns it to the condition before the spreading concerned and development are performed. And this wafer W is again sent to spreading and a development system, and same processing is performed again.

[0005] Moreover, in spreading and a developer, after forming the resist film using a monitor wafer apart from a product wafer, the monitor wafer is taken out from a carry in/out part 11, the thickness of the resist film is inspected in the inspection unit 15, and the rotational frequency of the spin chuck in the spreading unit of resist liquid etc. is adjusted. The monitor wafer which finished inspection of thickness carries out dissolution removal of the resist film in the washing unit 16, and he is trying to recycle it.

[0006]

[Problem(s) to be Solved by the Invention] However, since it inspected by having taken out one wafer W at a time to the inspection unit 15 delivery and here and the carrier C taken out from spreading and a development system is returned to Carrier C, it is the cause of a fall of a throughput. Moreover, when adjusting a resist spreading unit using a monitor wafer, once take out besides a spreading development system and thickness of the resist film is inspected. Furthermore, since the operator did washing removal manually and has returned the resist film to spreading and a development system Since an operator has to come and go between spreading, a development system, and external inspection units and has to perform washing of a monitor wafer, an activity is troublesome and the technical problem that automation is also difficult occurs.

[0007] In operating spreading and a developer and conducting inspection of the substrate after processing, or a monitor substrate, the purpose is in offering the technique in which improvement in a throughput can be aimed at, and offering a technique with easy automation by making this invention under such a situation.

[0008]

[Means for Solving the Problem] In spreading and the developer which invention of claim 1 develops the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the development section, With the pattern Banking Inspection Department which inspects the resist pattern formed in the substrate after a development It is characterized by having a classification \*\*\*\*\* means from the substrate judged in the substrate judged in this pattern Banking Inspection Department to be a rejection to be success.

[0009] A conveyance means consists of the 1st conveyance section which delivers with said carrier and conveys a substrate between locations, and the 2nd conveyance section which conveys a substrate between said delivery location, the spreading section, and the development section in this case, and the pattern Banking Inspection Department is prepared in the conveyance field of said 1st conveyance section.

[0010] Since according to this invention the pattern Banking Inspection Department is prepared in spreading and a developer and the success substrate and the rejection substrate are classified, the success substrate which finished processing can be promptly conveyed at the following process. Moreover, since pattern inspection can be conducted digesting the latency time of taking out of the carrier in a carrier carry in/out part, compared with the case where establish the pattern Banking Inspection Department in the exterior of equipment, and it takes out and inspects one substrate at a time out of a carrier, a throughput is high.

[0011] A classification means is considered as a configuration including the carrier for rejections which contains a rejection substrate to dedication, and said conveyance means, and a conveyance means returns the substrate judged to be success to the carrier of a carrier carry in/out part, and you may make it specifically convey the carrier judged to be a rejection on said carrier for rejections. If it does in this way, since a rejection substrate is not contained in the carrier taken out from a carrier carry in/out part, in it, it can obtain a still higher throughput.

[0012] Moreover, a classification means may be a marking means to perform marking to a rejected substrate, or a rejected substrate may be the storage section which memorizes of which storing location of which carrier it is a substrate.

[0013] In spreading and the developer which invention of claim 6 develops the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the

development section, The thickness of the resist film of the monitor substrate taken out from the monitor substrate stowage which contains a monitor substrate, and this monitor substrate stowage is measured, and it is characterized by having the thickness measurement section which judges whether the resist film is suitable thickness.

[0014] According to this invention, since thickness measurement of a monitor wafer is performed within spreading and a developer, it is efficiently maintainable. In this case, it is desirable for the solvent from the solvent nozzle in which it was prepared by the spreading section to remove the resist film of the whole front face of the monitor substrate with which thickness was measured in the thickness measurement section, and to reproduce a substrate, and if it does in this way, processing of a monitor substrate can be performed automatically.

[0015] Moreover, the cooling section which cools the substrate heated by spreading and the developer by the heating unit for performing pretreatment and/or after treatment and this heating unit is prepared, either [ at least ] a heating unit or the cooling sections may be arranged to multistage, a shelf may be constituted, and the stage of 1 of this shelf may be used as the thickness measurement section. [ usually as opposed to spreading processing of a resist and a development ]

[0016] This invention is above good also as a configuration equipped with a means to judge for every substrate whether it is necessary to reproduce a substrate or and whether there is nothing, by removing the resist film on a substrate with reference to said processing hysteresis storage section, when the processing hysteresis storage section which memorizes the processing hysteresis of each substrate, and operation of equipment stop and processing is interrupted. Without reproducing a substrate uniformly, when doing in this way and equipment is downed, since what is necessary is to process only a substrate to be reproduced, it is not necessary to perform useless processing.

[0017] Moreover, this invention conveys the substrate judged in the pattern Banking Inspection Department to be a rejection to a washing unit using spreading and the developer which were indicated by claim 1, and is realized by washing a substrate here and removing the resist film also as a substrate regeneration system which reproduces a substrate, returns the reproduced substrate to said spreading and a developer, and forms a resist pattern again.

[0018]

[Embodiment of the Invention] Spreading which drawing 1 requires for the gestalt of operation of this invention, spreading which comes to connect a developer 100 with an aligner 200, the perspective view showing the outline of the whole development system, and drawing 2 are the top views showing the interior of this system. Spreading and a developer 100 are equipped with the 1st wafer conveyance section 21 which delivers Wafer W between the carrier carry in/out part 2 to which carrying-in appearance of the wafer carrier (only henceforth a "carrier") C which forms the conveyance container with which the wafer W which are two or more substrates, for example, 25 sheets, was held ledged is carried out, the processing section 3 for applying to Wafer W and performing a development, and this processing section 3 and said carrier carry in/out part 2.

[0019] Said carrier carry in/out part 2 is constituted as a stage in which four carriers C are laid. The 1st wafer conveyance section 21 prepares the arm which can move freely to the pedestal [ move / and / to X, Y, and a Z direction / it / freely ] which can be freely rotated to the circumference of a vertical axis, and is constituted. The pattern Banking Inspection Department 4 which inspects the resist pattern formed in the wafer W after a development is established in the flank of the conveyance field of this 1st wafer conveyance section 21, for example, spreading, and the body of a developer. This pattern Banking Inspection Department 4 is for inspecting about the line breadth of a resist pattern, the lap condition of a resist pattern and the substrate film, a development defect, and the spreading nonuniformity of a resist, for example, can inspect by analyzing the image of the wafer obtained with 3 CCD cameras with a personal computer.

[0020] Moreover, it is the conveyance field of said 1st wafer conveyance section 21, and the carrier 40 for containing the wafer W judged in this pattern Banking Inspection Department 4 to be a rejection to the lower part side of the pattern Banking Inspection Department 4 is placed on

installation base 40a. In addition, this carrier 40 is the same as said carrier C. Drawing 3 is the perspective view showing the pattern Banking Inspection Department 4 and a carrier 40. In said the 1st wafer conveyance section 21 and carrier 40, the classification \*\*\*\*\* means is made in this example from the wafer W judged in the wafer W judged to be a rejection to be success. [0021] The 2nd wafer conveyance section 22 by which the processing section 3 is called the Maine conveyance arm etc. in the center is formed, and Shelves 5A and 5B are formed, respectively before and after this 2nd wafer conveyance section 22 (it expresses in the direction of [ when seeing the back from the carrier carry in/out part 2 ]). Two or more units are accumulated, these shelves 5A and 5B are constituted, as shown in drawing 4 , the alignment unit for carrying out alignment of the heating unit which heats a wafer to these units, and a wafer etc. is assigned, and one of the unit groups is further assigned as a delivery unit 51 of a wafer. In addition, assignment of the unit shown in drawing 4 is a thing when [ expedient ] an image is shown, is not restrained by this assignment and may divide a heating unit and a refrigeration unit into a separate shelf. In addition, the same shelf 5C as said shelves 5A and 5B may be prepared so that it can slide along with a guide rail GL, as shown in drawing 2 .

[0022] As shown in drawing 4 , while the thickness measurement section 50 is formed in the maximum upper case, the monitor wafer stowage 52 for containing two or more monitor wafers of said shelf 5B (or 5A, 5C) is established in the stage under it. In order that a monitor wafer may check periodically the parameter concerning the spreading section mentioned later etc., it is a product wafer and the wafer only for inspection with which same processing is performed, and the thickness measurement section 50 inspects the thickness of the resist film formed in this monitor wafer. The film pressure test section 50 is constituted by the optical interference type thickness gage containing for example, an epi-illumination mold microscope, a spectroscope, and the data-processing section. In this optical interference type thickness gage, a wafer irradiates through an objective lens from the light source, and thickness is computed by analyzing the reflectance spectrum by which carried out incidence of the light reflected here to the spectroscope, and incidence was carried out here by computer.

[0023] The two development sections 23 are formed in an upper case side, and the two spreading sections 6 are formed in the right-hand side of said 2nd wafer conveyance section 22 at the lower-berth side. Said 2nd wafer conveyance section 22 is constituted free [ rotation ease and an attitude ] at the circumference of rise-and-fall ease and a vertical axis, and has the role which delivers Wafer W between each unit of Shelves 5A-5C, the spreading section 6, and the development section 23. In addition, the 1st wafer conveyance section 21 and the 2nd wafer conveyance section 22 constitute the wafer conveyance means from this example.

[0024] The spreading section 6 and the development section 23 are the almost same configurations, and they are explained briefly, referring to drawing 5 about the structure of the spreading section 6. 61 in drawing 5 is the cup from which exhaust air way 61a was formed, and the spin chuck 62 is formed in this. This spin chuck 62 has composition which can go up and down by Motor M so that the wafer W carried in by the 2nd wafer conveyance section 22 through the delivery opening 64 of a case 63 can be received. The nozzle is prepared above the cup 61. There is a solvent nozzle which supplies, the resist nozzle and solvent, for example, the thinner, which supplies a resist, among the nozzles. Drawing 5 has shown the solvent nozzle as 65. The solvent nozzle 65 is for supplying thinner on Wafer W, in order to improve \*\*\*\* before applying a resist. The solvent nozzle 65 is supported by the support arm 66, is guided at a rail 67, and moves in (the direction of a front flesh side of space) at a horizontal. It is constituted so that it can move similarly about a resist nozzle. About spreading of a resist, a resist is supplied to the core of the wafer W which is rotating by the spin chuck 62 from a resist nozzle, and a centrifugal force extends and it is applied.

[0025] Moreover, spreading and a developer 100 are equipped with the interface section 24, and the processing section 3 is connected to the aligner 200 through this interface section 24. This interface section 24 is equipped with the conveyance arm 25 for conveying Wafer W for between the delivery unit 51 of said shelf 5B, and aligners 200.

[0026] It states referring to drawing 6 here about pattern inspection of Wafer W, and the relation between the result of thickness measurement, and the transfer control of the subsequent wafer



W. Although the wafer W which finished the development is conveyed by the pattern Banking Inspection Department 4 and inspection is conducted like previous statement here, the 1st wafer conveyance section 21 is controlled by the control section 7 so that it is conveyed by the carrier C currently laid in the carrier carry in/out part 2 about the wafer W whose inspection result is success and is conveyed by the carrier 40 about the wafer W whose inspection result is a rejection. Moreover, the 2nd wafer conveyance section 22 is controlled by the control section 7 so that the monitor wafer inspected in the thickness measurement section 50 is returned to the spreading section 6. The spreading section 6 operates so that dissolution washing of the resist of the whole wafer surface may be carried out with thinner like the after-mentioned. Control of these single strings is performed by the program stored in the control section 7.

[0027] Although spreading and a developer 100 are constituted as mentioned above, as shown in drawing 7, the washing section 8 from which the inspection result in the pattern Banking Inspection Department 4 washes the wafer W used as a rejection with a drug solution, and removes the pattern of the whole wafer W surface is formed in the exterior of this equipment. The system which consists of said spreading, a developer 100, and the washing section 8 is equivalent to the gestalt of operation of the substrate regeneration system of this invention.

[0028] Subsequently, an operation of the gestalt of the above-mentioned implementation is described. Carrier C is first carried in to the carrier carry in/out part 2 from the exterior, and Wafer W is taken out from the inside of this carrier C by the 1st wafer conveyance section 21. Wafer W is received and passed to the 2nd wafer conveyance section 22 through the delivery unit 51 of shelf 5A from the 1st wafer conveyance section 21, further, sequential conveyance is carried out and predetermined processing, for example, hydrophobing processing, cooling processing, etc. are performed to the processing unit of shelf 5A (or 5B, 5C). Then, after a resist is applied in the spreading section 6 and this wafer W is heat-treated further, it is sent to an aligner 200 through the interface section 24 from the delivery unit 51 of shelf 5B.

[0029] The wafer W exposed with the aligner 200 is returned to the processing section 3 in a reverse path, it is conveyed by the development section 23 by the 2nd wafer conveyance section 22, and a development is carried out. In addition, Wafer W is heat-treated and cooling processed before a development in detail. The wafer W by which the development was carried out is received and passed to the 1st wafer conveyance section 21 in a path contrary to \*\*\*\*, is carried in to the pattern Banking Inspection Department 4 after that, and the line breadth, the lap condition of a pattern and the substrate film, the development nonuniformity, and the development defect of a pattern are inspected.

[0030] As shown in drawing 7, the wafer W whose pattern inspection result is success is returned to the original carrier C currently laid in the carrier carry in/out part 2 by the 1st wafer conveyance section 21, and the wafer W whose pattern inspection result is a rejection is contained by the 1st wafer conveyance section 21 by the carrier 40 in the lower part side of the pattern Banking Inspection Department 4. That is, with the 1st wafer conveyance section 21 and carrier 40, the rejected goods of pattern inspection become classification eclipse \*\*\*\*\* from an accepted product.

[0031] Carrier C is conveyed at the next station and a carrier 40 is conveyed by the operator at the washing section 8. In the washing section 8, two or more sorts of drug solution tubs are prepared, the wafer W concerned is dipped in the drug solution tub according to the class of resist which makes the pattern on Wafer W, dissolution removal of the resist of the whole wafer W surface is carried out, it returns to the condition before being carried in to spreading and a developer 100, that is, Wafer W is reproduced. The reproduced wafer W is contained by the carrier, is carried in to spreading and the carrier carry in/out part 2 of a developer 100 by the operator, and spreading, exposure, and a development are performed again.

[0032] In order to check the engine speed of each processing 62 in spreading and a development system, for example, a spin chuck, etc. periodically here, a monitor wafer is taken out from the monitor wafer stowage 52 of shelf 5B by the 2nd wafer conveyance section 22, it conveys in the spreading section 6, and a resist is applied and it conveys in the thickness measurement section 50 of shelf 5B. Thickness being measured in the thickness measurement section 50, being conveyed by the spreading section 6, and a spin chuck 62 being adsorbed, and rotating, the

thinner which is a solvent is supplied from the solvent nozzle 65, dissolution removal is carried out, the resist of the whole surface of a monitor wafer is reproduced, and a monitor wafer is returned to the monitor wafer stowage 50 after that. In addition, exposure and a development are performed like [ wafer / monitor ] a product wafer, and you may make it inspect a pattern in the pattern Banking Inspection Department 4.

[0033] According to the gestalt of such operation, there is effectiveness like the next. Since the wafer which inspected the pattern and passed inspection, and the rejected wafer are classified while forming the pattern Banking Inspection Department 4 in spreading and a developer 100, and conveying the wafer W by which the development was carried out to the carrier carry in/out part 2, A success wafer can be conveyed at degree process with Carrier C as it is, and a high throughput is obtained compared with the case where took out one sheet at a time from the inside of Carrier C in the exterior of spreading and a developer, and the pattern is being inspected.

[0034] Moreover, since the resist film formed in the monitor wafer is removed using the thinner from the solvent nozzle of the spreading section 6 and he is trying to reproduce while measuring the thickness of a monitor wafer within spreading and a developer, automation can be attained and efficient processing can be performed. In this case, since BEAUEHA in which the pattern is not formed is used for a substrate, a monitor wafer can remove a resist certainly by supply of the thinner from a solvent nozzle, and rotation of a wafer. Further for example, if the thickness measurement section 50 and a monitor wafer arrange a stowage 52 to a part of shelf 5B, since it is not necessary to secure a superficial tooth space exceptionally, enlargement of equipment can be suppressed.

[0035] this invention may form the washing section 8 above at spreading and a developer 100, for example, it is the conveyance field of the 1st wafer conveyance section 21, and you may make it for it to be alike and prepare in left-hand side (the pattern Banking Inspection Department 4 and opposite side) toward the back side of equipment, from the carrier carry in/out part 2 If it does in this way, regeneration of a product wafer is automatable.

[0036] Moreover, as classification \*\*\*\*\*, a marking means is established for the success wafer of pattern inspection in the pattern Banking Inspection Department 4 from a rejection wafer, and to a rejection wafer, ink is dropped at the periphery section, it may be made to carry out marking to it from a marking means, and you may make it store an inspection result in the storage section 82 through the data-processing section 81, as shown in drawing 8 . In the storage section 82, the result of the identification code of a wafer, the identification code of the lot with which the wafer belongs, the identification code of the carrier C with which the wafer has been carried, the stowed position (slot location) in the carrier C, and pattern inspection is matched and stored, for example. Therefore, after taking out Carrier C, by referring to the data of this storage section 82 by the control-system side at the washing section or the next station, a success wafer and a rejection wafer can be distinguished and the following process can be promptly performed to a success wafer. In these examples, said marking means and the storage section 82 are equivalent to a classification means.

[0037] Furthermore, although it regenerates to the wafer in the middle of down stream processing when spreading and operation of a developer stop according to a trouble and processing is interrupted, it explains, referring to drawing 9 about the desirable technique in this case. The processing hysteresis of each wafer W is incorporated by the control section 84, Wafer W and processing hysteresis are matched, and it memorizes in the storage section 83. In this example, the identification code of the lot with which Wafer W belongs is also matched and memorized. With processing hysteresis, a wafer is heat-treating under heat-treatment under heat-treatment under hydrophobing processing and after resist spreading, and before after [ exposure ] development, and after development. And when the system was downed and processing interrupts a control section 84, Judge whether with reference to the processing hysteresis in the storage section 83, each wafer needs to remove a resist and needs to be reproduced, or processing can be continued as it is, and that result is written in the storage section 83 (this writing may be performed before a system is downed). The 2nd wafer conveyance section 22 is operated based on this result, and it conveys on the carrier 40 for

rejections about the wafer W to be reproduced. Moreover, about the wafer W without the need for playback, processing is continued as it is.

[0038] For example, since the development planned if management of the time amount of heat-treatment after exposure is severe and is heated beyond a certain time amount becomes impossible when the resist of a chemistry magnification mold is used, about the wafer under this heat-treatment, regeneration is needed. On the other hand, there is no need for playback that what is necessary is just to continue processing to the wafer W of the phase in the heat-treatment after development since it is satisfactory especially even if time amount is long. Therefore, if processing hysteresis is managed in this way, since it is not necessary to reproduce Wafer W uniformly, it is not necessary to perform unnecessary regeneration, without making processing useless.

[0039] In addition, as a substrate, you may be a glass substrate not only a wafer but for liquid crystal displays.

[0040]

[Effect of the Invention] In inspecting the substrate after processing according to this invention, as mentioned above, since the pattern Banking Inspection Department and the thickness measurement section are prepared in spreading and a developer, improvement in a throughput can be aimed at. Moreover, the correspondence to automation becomes easy by preparing the washing section in spreading and a developer, or removing a resist using the solvent nozzle of the spreading section.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the system which regenerates that substrate, when the processing state of the substrate processed with spreading which forms the resist film in a substrate, develops negatives to the substrate after exposure and forms a desired pattern, a developer, and this equipment is not good.

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PRIOR ART

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[Description of the Prior Art] In the manufacture process of a semiconductor device, resist liquid is applied to substrates, such as a semi-conductor wafer, the resist film is exposed using a photo mask, and the photolithography technique which produces on a substrate the resist mask which has a desired pattern is used by developing it.

[0003] This photolithography is performed by the system which connected aligner 1B to spreading developer 1A as shown in the schematic diagram of drawing 10 . if the case where a semi-conductor wafer (henceforth a wafer) is processed is taken for an example, spreading developer 1A will become the carry in/out part 11 which carries out carrying-in appearance of the wafer carrier C, and the delivery arm 12 which picks out a wafer from the carrier C laid in this carry in/out part 11 from spreading, the development section 13, and the interface section 14, and will be connected to aligner 1B. The resist film is formed, the wafer W carried in to the spreading development section 13 through the delivery arm 12 is exposed in aligner 1B, and a development is returned and carried out after that to spreading and the development section 13, and it is returned to Carrier C through the delivery arm 12.

[0004] If the wafer W which finished processing is contained by Carrier C, Carrier C will be taken out by an operator or the automatic carrier robot from a carry in/out part 11, and will be conveyed by the inspection unit 15 with him. In this inspection unit 15, it inspects about spreading nonuniformity, a development defect, etc. of the line breadth of the resist pattern formed on Wafer W, the lap condition of a resist pattern and a substrate pattern, and a resist. And although the wafer W judged to be success is sent to degree process, the wafer W judged to be a rejection is sent to the washing unit 16. The device formed on Wafer W is making multilayer structure, although one device is created, since it passes along a spreading development system also dozens times, in the washing unit 16, using the drug solution according to each phase, it is immersed in Wafer W into the drug solution, carries out dissolution removal of the resist, and returns it to the condition before the spreading concerned and development are performed. And this wafer W is again sent to spreading and a development system, and same processing is performed again.

[0005] Moreover, in spreading and a developer, after forming the resist film using a monitor wafer apart from a product wafer, the monitor wafer is taken out from a carry in/out part 11, the thickness of the resist film is inspected in the inspection unit 15, and the rotational frequency of the spin chuck in the spreading unit of resist liquid etc. is adjusted. The monitor wafer which finished inspection of thickness carries out dissolution removal of the resist film in the washing unit 16, and he is trying to recycle it.

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[Translation done.]

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] In inspecting the substrate after processing according to this invention, as mentioned above, since the pattern Banking Inspection Department and the thickness measurement section are prepared in spreading and a developer, improvement in a throughput can be aimed at. Moreover, the correspondence to automation becomes easy by preparing the washing section in spreading and a developer, or removing a resist using the solvent nozzle of the spreading section.

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] However, since it inspected by having taken out one wafer W at a time to the inspection unit 15 delivery and here and the carrier C taken out from spreading and a development system is returned to Carrier C, it is the cause of a fall of a throughput. Moreover, when adjusting a resist spreading unit using a monitor wafer, once take out besides a spreading development system and thickness of the resist film is inspected. Furthermore, since the operator did washing removal manually and has returned the resist film to spreading and a development system Since an operator has to come and go between spreading, a development system, and external inspection units and has to perform washing of a monitor wafer, an activity is troublesome and the technical problem that automation is also difficult occurs.

[0007] In operating spreading and a developer and conducting inspection of the substrate after processing, or a monitor substrate, the purpose is in offering the technique in which improvement in a throughput can be aimed at, and offering a technique with easy automation by making this invention under such a situation.

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[Translation done.]

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MEANS

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[Means for Solving the Problem] In spreading and the developer which invention of claim 1 develops the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the development section, With the pattern Banking Inspection Department which inspects the resist pattern formed in the substrate after a development It is characterized by having a classification \*\*\*\*\* means from the substrate judged in the substrate judged in this pattern Banking Inspection Department to be a rejection to be success.

[0009] A conveyance means consists of the 1st conveyance section which delivers with said carrier and conveys a substrate between locations, and the 2nd conveyance section which conveys a substrate between said delivery location, the spreading section, and the development section in this case, and the pattern Banking Inspection Department is prepared in the conveyance field of said 1st conveyance section.

[0010] Since according to this invention the pattern Banking Inspection Department is prepared in spreading and a developer and the success substrate and the rejection substrate are classified, the success substrate which finished processing can be promptly conveyed at the following process. Moreover, since pattern inspection can be conducted digesting the latency time of taking out of the carrier in a carrier carry in/out part, compared with the case where establish the pattern Banking Inspection Department in the exterior of equipment, and it takes out and inspects one substrate at a time out of a carrier, a throughput is high.

[0011] A classification means is considered as a configuration including the carrier for rejections which contains a rejection substrate to dedication, and said conveyance means, and a conveyance means returns the substrate judged to be success to the carrier of a carrier carry in/out part, and you may make it specifically convey the carrier judged to be a rejection on said carrier for rejections. If it does in this way, since a rejection substrate is not contained in the carrier taken out from a carrier carry in/out part, in it, it can obtain a still higher throughput.

[0012] Moreover, a classification means may be a marking means to perform marking to a rejected substrate, or a rejected substrate may be the storage section which memorizes of which storing location of which carrier it is a substrate.

[0013] In spreading and the developer which invention of claim 6 develops the substrate after exposure while applying a resist to a substrate, and are connected to an aligner The carrier carry in/out part to which carrying-in appearance of the carrier with which two or more substrates were contained is carried out, The spreading section which applies a resist to the substrate picked out from the carrier carried in to this carrier carry in/out part, The conveyance means for conveying a substrate between the development section which develops negatives to the substrate after exposure, and said carrier carry in/out part, the spreading section and the development section, The thickness of the resist film of the monitor substrate taken out from the monitor substrate stowage which contains a monitor substrate, and this monitor substrate



stowage is measured, and it is characterized by having the thickness measurement section which judges whether the resist film is suitable thickness.

[0014] According to this invention, since thickness measurement of a monitor wafer is performed within spreading and a developer, it is efficiently maintainable. In this case, it is desirable for the solvent from the solvent nozzle in which it was prepared by the spreading section to remove the resist film of the whole front face of the monitor substrate with which thickness was measured in the thickness measurement section, and to reproduce a substrate, and if it does in this way, processing of a monitor substrate can be performed automatically.

[0015] Moreover, the cooling section which cools the substrate heated by spreading and the developer by the heating unit for performing pretreatment and/or after treatment and this heating unit is prepared, either [ at least ] a heating unit or the cooling sections may be arranged to multistage, a shelf may be constituted, and the stage of 1 of this shelf may be used as the thickness measurement section. [ usually as opposed to spreading processing of a resist and a development ]

[0016] This invention is above good also as a configuration equipped with a means to judge for every substrate whether it is necessary to reproduce a substrate or and whether there is nothing, by removing the resist film on a substrate with reference to said processing hysteresis storage section, when the processing hysteresis storage section which memorizes the processing hysteresis of each substrate, and operation of equipment stop and processing is interrupted. Without reproducing a substrate uniformly, when doing in this way and equipment is downed, since what is necessary is to process only a substrate to be reproduced, it is not necessary to perform useless processing.

[0017] Moreover, this invention conveys the substrate judged in the pattern Banking Inspection Department to be a rejection to a washing unit using spreading and the developer which were indicated by claim 1, and is realized by washing a substrate here and removing the resist film also as a substrate regeneration system which reproduces a substrate, returns the reproduced substrate to said spreading and a developer, and forms a resist pattern again.

[0018]

[Embodiment of the Invention] Spreading which drawing 1 requires for the gestalt of operation of this invention, spreading which comes to connect a developer 100 with an aligner 200, the perspective view showing the outline of the whole development system, and drawing 2 are the top views showing the interior of this system. Spreading and a developer 100 are equipped with the 1st wafer conveyance section 21 which delivers Wafer W between the carrier carry in/out part 2 to which carrying-in appearance of the wafer carrier (only henceforth a "carrier") C which forms the conveyance container with which the wafer W which are two or more substrates, for example, 25 sheets, was held ledged is carried out, the processing section 3 for applying to Wafer W and performing a development, and this processing section 3 and said carrier carry in/out part 2.

[0019] Said carrier carry in/out part 2 is constituted as a stage in which four carriers C are laid. The 1st wafer conveyance section 21 prepares the arm which can move freely to the pedestal [ move / and / to X, Y, and a Z direction / it / freely ] which can be freely rotated to the circumference of a vertical axis, and is constituted. The pattern Banking Inspection Department 4 which inspects the resist pattern formed in the wafer W after a development is established in the flank of the conveyance field of this 1st wafer conveyance section 21, for example, spreading, and the body of a developer. This pattern Banking Inspection Department 4 is for inspecting about the line breadth of a resist pattern, the lap condition of a resist pattern and the substrate film, a development defect, and the spreading nonuniformity of a resist, for example, can inspect by analyzing the image of the wafer obtained with 3 CCD cameras with a personal computer.

[0020] Moreover, it is the conveyance field of said 1st wafer conveyance section 21, and the carrier 40 for containing the wafer W judged in this pattern Banking Inspection Department 4 to be a rejection to the lower part side of the pattern Banking Inspection Department 4 is placed on installation base 40a. In addition, this carrier 40 is the same as said carrier C. Drawing 3 is the perspective view showing the pattern Banking Inspection Department 4 and a carrier 40. In said

the 1st wafer conveyance section 21 and carrier 40, the classification \*\*\*\*\* means is made in this example from the wafer W judged in the wafer W judged to be a rejection to be success. [0021] The 2nd wafer conveyance section 22 by which the processing section 3 is called the Maine conveyance arm etc. in the center is formed, and Shelves 5A and 5B are formed, respectively before and after this 2nd wafer conveyance section 22 (it expresses in the direction of [ when seeing the back from the carrier carry in/out part 2 ]). Two or more units are accumulated, these shelves 5A and 5B are constituted, as shown in drawing 4 , the alignment unit for carrying out alignment of the heating unit which heats a wafer to these units, and a wafer etc. is assigned, and one of the unit groups is further assigned as a delivery unit 51 of a wafer. In addition, assignment of the unit shown in drawing 4 is a thing when [ expedient ] an image is shown, is not restrained by this assignment and may divide a heating unit and a refrigeration unit into a separate shelf. In addition, the same shelf 5C as said shelves 5A and 5B may be prepared so that it can slide along with a guide rail GL, as shown in drawing 2 .

[0022] As shown in drawing 4 , while the thickness measurement section 50 is formed in the maximum upper case, the monitor wafer stowage 52 for containing two or more monitor wafers of said shelf 5B (or 5A, 5C) is established in the stage under it. In order that a monitor wafer may check periodically the parameter concerning the spreading section mentioned later etc., it is a product wafer and the wafer only for inspection with which same processing is performed, and the thickness measurement section 50 inspects the thickness of the resist film formed in this monitor wafer. The film pressure test section 50 is constituted by the optical interference type thickness gage containing for example, an epi-illumination mold microscope, a spectroscope, and the data-processing section. In this optical interference type thickness gage, a wafer irradiates through an objective lens from the light source, and thickness is computed by analyzing the reflectance spectrum by which carried out incidence of the light reflected here to the spectroscope, and incidence was carried out here by computer.

[0023] The two development sections 23 are formed in an upper case side, and the two spreading sections 6 are formed in the right-hand side of said 2nd wafer conveyance section 22 at the lower-berth side. Said 2nd wafer conveyance section 22 is constituted free [ rotation ease and an attitude ] at the circumference of rise-and-fall ease and a vertical axis, and has the role which delivers Wafer W between each unit of Shelves 5A-5C, the spreading section 6, and the development section 23. In addition, the 1st wafer conveyance section 21 and the 2nd wafer conveyance section 22 constitute the wafer conveyance means from this example.

[0024] The spreading section 6 and the development section 23 are the almost same configurations, and they are explained briefly, referring to drawing 5 about the structure of the spreading section 6. 61 in drawing 5 is the cup from which exhaust air way 61a was formed, and the spin chuck 62 is formed in this. This spin chuck 62 has composition which can go up and down by Motor M so that the wafer W carried in by the 2nd wafer conveyance section 22 through the delivery opening 64 of a case 63 can be received. The nozzle is prepared above the cup 61. There is a solvent nozzle which supplies, the resist nozzle and solvent, for example, the thinner, which supplies a resist, among the nozzles. Drawing 5 has shown the solvent nozzle as 65. The solvent nozzle 65 is for supplying thinner on Wafer W, in order to improve \*\*\*\* before applying a resist. The solvent nozzle 65 is supported by the support arm 66, is guided at a rail 67, and moves in (the direction of a front flesh side of space) at a horizontal. It is constituted so that it can move similarly about a resist nozzle. About spreading of a resist, a resist is supplied to the core of the wafer W which is rotating by the spin chuck 62 from a resist nozzle, and a centrifugal force extends and it is applied.

[0025] Moreover, spreading and a developer 100 are equipped with the interface section 24, and the processing section 3 is connected to the aligner 200 through this interface section 24. This interface section 24 is equipped with the conveyance arm 25 for conveying Wafer W for between the delivery unit 51 of said shelf 5B, and aligners 200.

[0026] It states referring to drawing 6 here about pattern inspection of Wafer W, and the relation between the result of thickness measurement, and the transfer control of the subsequent wafer W. Although the wafer W which finished the development is conveyed by the pattern Banking Inspection Department 4 and inspection is conducted like previous statement here, the 1st wafer

conveyance section 21 is controlled by the control section 7 so that it is conveyed by the carrier C currently laid in the carrier carry in/out part 2 about the wafer W whose inspection result is success and is conveyed by the carrier 40 about the wafer W whose inspection result is a rejection. Moreover, the 2nd wafer conveyance section 22 is controlled by the control section 7 so that the monitor wafer inspected in the thickness measurement section 50 is returned to the spreading section 6. The spreading section 6 operates so that dissolution washing of the resist of the whole wafer surface may be carried out with thinner like the after-mentioned. Control of these single strings is performed by the program stored in the control section 7.

[0027] Although spreading and a developer 100 are constituted as mentioned above, as shown in drawing 7, the washing section 8 from which the inspection result in the pattern Banking Inspection Department 4 washes the wafer W used as a rejection with a drug solution, and removes the pattern of the whole wafer W surface is formed in the exterior of this equipment. The system which consists of said spreading, a developer 100, and the washing section 8 is equivalent to the gestalt of operation of the substrate regeneration system of this invention.

[0028] Subsequently, an operation of the gestalt of the above-mentioned implementation is described. Carrier C is first carried in to the carrier carry in/out part 2 from the exterior, and Wafer W is taken out from the inside of this carrier C by the 1st wafer conveyance section 21. Wafer W is received and passed to the 2nd wafer conveyance section 22 through the delivery unit 51 of shelf 5A from the 1st wafer conveyance section 21, further, sequential conveyance is carried out and predetermined processing, for example, hydrophobing processing, cooling processing, etc. are performed to the processing unit of shelf 5A (or 5B, 5C). Then, after a resist is applied in the spreading section 6 and this wafer W is heat-treated further, it is sent to an aligner 200 through the interface section 24 from the delivery unit 51 of shelf 5B.

[0029] The wafer W exposed with the aligner 200 is returned to the processing section 3 in a reverse path, it is conveyed by the development section 23 by the 2nd wafer conveyance section 22, and a development is carried out. In addition, Wafer W is heat-treated and cooling processed before a development in detail. The wafer W by which the development was carried out is received and passed to the 1st wafer conveyance section 21 in a path contrary to \*\*\*\*, is carried in to the pattern Banking Inspection Department 4 after that, and the line breadth, the lap condition of a pattern and the substrate film, the development nonuniformity, and the development defect of a pattern are inspected.

[0030] As shown in drawing 7, the wafer W whose pattern inspection result is success is returned to the original carrier C currently laid in the carrier carry in/out part 2 by the 1st wafer conveyance section 21, and the wafer W whose pattern inspection result is a rejection is contained by the 1st wafer conveyance section 21 by the carrier 40 in the lower part side of the pattern Banking Inspection Department 4. That is, with the 1st wafer conveyance section 21 and carrier 40, the rejected goods of pattern inspection become classification eclipse \*\*\*\*\* from an accepted product.

[0031] Carrier C is conveyed at the next station and a carrier 40 is conveyed by the operator at the washing section 8. In the washing section 8, two or more sorts of drug solution tubs are prepared, the wafer W concerned is dipped in the drug solution tub according to the class of resist which makes the pattern on Wafer W, dissolution removal of the resist of the whole wafer W surface is carried out, it returns to the condition before being carried in to spreading and a developer 100, that is, Wafer W is reproduced. The reproduced wafer W is contained by the carrier, is carried in to spreading and the carrier carry in/out part 2 of a developer 100 by the operator, and spreading, exposure, and a development are performed again.

[0032] In order to check the engine speed of each processing 62 in spreading and a development system, for example, a spin chuck, etc. periodically here, a monitor wafer is taken out from the monitor wafer stowage 52 of shelf 5B by the 2nd wafer conveyance section 22, it conveys in the spreading section 6, and a resist is applied and it conveys in the thickness measurement section 50 of shelf 5B. Thickness being measured in the thickness measurement section 50, being conveyed by the spreading section 6, and a spin chuck 62 being adsorbed, and rotating, the thinner which is a solvent is supplied from the solvent nozzle 65, dissolution removal is carried out, the resist of the whole surface of a monitor wafer is reproduced, and a monitor wafer is

returned to the monitor wafer stowage 50 after that. In addition, exposure and a development are performed like [ wafer / monitor ] a product wafer, and you may make it inspect a pattern in the pattern Banking Inspection Department 4.

[0033] According to the gestalt of such operation, there is effectiveness like the next. Since the wafer which inspected the pattern and passed inspection, and the rejected wafer are classified while forming the pattern Banking Inspection Department 4 in spreading and a developer 100, and conveying the wafer W by which the development was carried out to the carrier carry in/out part 2, A success wafer can be conveyed at degree process with Carrier C as it is, and a high throughput is obtained compared with the case where took out one sheet at a time from the inside of Carrier C in the exterior of spreading and a developer, and the pattern is being inspected. [0034] Moreover, since the resist film formed in the monitor wafer is removed using the thinner from the solvent nozzle of the spreading section 6 and he is trying to reproduce while measuring the thickness of a monitor wafer within spreading and a developer, automation can be attained and efficient processing can be performed. In this case, since BEAUEHA in which the pattern is not formed is used for a substrate, a monitor wafer can remove a resist certainly by supply of the thinner from a solvent nozzle, and rotation of a wafer. Further for example, if the thickness measurement section 50 and a monitor wafer arrange a stowage 52 to a part of shelf 5B, since it is not necessary to secure a superficial tooth space exceptionally, enlargement of equipment can be suppressed.

[0035] this invention may form the washing section 8 above at spreading and a developer 100, for example, it is the conveyance field of the 1st wafer conveyance section 21, and you may make it for it to be alike and prepare in left-hand side (the pattern Banking Inspection Department 4 and opposite side) toward the back side of equipment, from the carrier carry in/out part 2 If it does in this way, regeneration of a product wafer is automatable.

[0036] Moreover, as classification \*\*\*\*\*, a marking means is established for the success wafer of pattern inspection in the pattern Banking Inspection Department 4 from a rejection wafer, and to a rejection wafer, ink is dropped at the periphery section, it may be made to carry out marking to it from a marking means, and you may make it store an inspection result in the storage section 82 through the data-processing section 81, as shown in drawing 8 . In the storage section 82, the result of the identification code of a wafer, the identification code of the lot with which the wafer belongs, the identification code of the carrier C with which the wafer has been carried, the stowed position (slot location) in the carrier C, and pattern inspection is matched and stored, for example. Therefore, after taking out Carrier C, by referring to the data of this storage section 82 by the control-system side at the washing section or the next station, a success wafer and a rejection wafer can be distinguished and the following process can be promptly performed to a success wafer. In these examples, said marking means and the storage section 82 are equivalent to a classification means.

[0037] Furthermore, although it regenerates to the wafer in the middle of down stream processing when spreading and operation of a developer stop according to a trouble and processing is interrupted, it explains, referring to drawing 9 about the desirable technique in this case. The processing hysteresis of each wafer W is incorporated by the control section 84, Wafer W and processing hysteresis are matched, and it memorizes in the storage section 83. In this example, the identification code of the lot with which Wafer W belongs is also matched and memorized. With processing hysteresis, a wafer is heat-treating under heat-treatment under heat-treatment under hydrophobing processing and after resist spreading, and before after [ exposure ] development, and after development. And when the system was downed and processing interrupts a control section 84, Judge whether with reference to the processing hysteresis in the storage section 83, each wafer needs to remove a resist and needs to be reproduced, or processing can be continued as it is, and that result is written in the storage section 83 (this writing may be performed before a system is downed). The 2nd wafer conveyance section 22 is operated based on this result, and it conveys on the carrier 40 for rejections about the wafer W to be reproduced. Moreover, about the wafer W without the need for playback, processing is continued as it is.

[0038] For example, since the development planned if management of the time amount of heat-

treatment after exposure is severe and is heated beyond a certain time amount becomes impossible when the resist of a chemistry magnification mold is used, about the wafer under this heat-treatment, regeneration is needed. On the other hand, there is no need for playback that what is necessary is just to continue processing to the wafer W of the phase in the heat-treatment after development since it is satisfactory especially even if time amount is long. Therefore, if processing hysteresis is managed in this way, since it is not necessary to reproduce Wafer W uniformly, it is not necessary to perform unnecessary regeneration, without making processing useless.

[0039] In addition, as a substrate, you may be a glass substrate not only a wafer but for liquid crystal displays.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] They are spreading concerning the gestalt of operation of this invention, and the general-view perspective view showing the system which combined the developer and the aligner.

[Drawing 2] It is the top view showing the interior of the above-mentioned system.

[Drawing 3] It is the perspective view showing the carrier for containing the pattern developer used for the gestalt of operation of this invention, and a rejection wafer.

[Drawing 4] It is the side elevation showing the interior of the above-mentioned system.

[Drawing 5] It is drawing of longitudinal section showing the spreading section.

[Drawing 6] It is the explanatory view showing the control system of the 1st wafer conveyance section and the 2nd wafer conveyance section.

[Drawing 7] It is spreading and the explanatory view showing the substrate regeneration system in a development concerning the gestalt of operation of this invention.

[Drawing 8] The result of pattern inspection is the explanatory view showing an example of classification \*\*\*\*\* for the wafer which is success, and the wafer which is a rejection.

[Drawing 9] While the data of the storage section for processing hysteresis used by this invention are shown notionally, it is the explanatory view showing a control system including the storage section.

[Drawing 10] It is the explanatory view showing the substrate regeneration system in the conventional spreading and a development.

[Description of Notations]

100 Spreading, Developer

200 Aligner

2 Carrier Carry In/out Part

21 1st Wafer Conveyance Section

22 2nd Wafer Conveyance Section

23 Development Section

3 Processing Section

4 Pattern Banking Inspection Department

40 Carrier for Rejections

50 Thickness Measurement Section

52 Monitor Wafer Stowage

6 Spreading Section

65 Solvent Nozzle

7 Control Section

8 Washing Section

82 83 Storage section

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[Translation done.]

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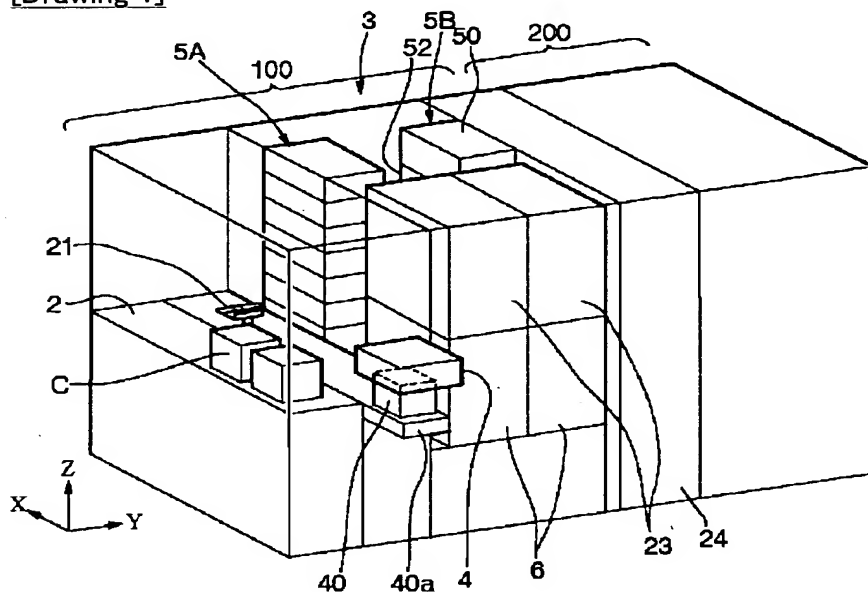
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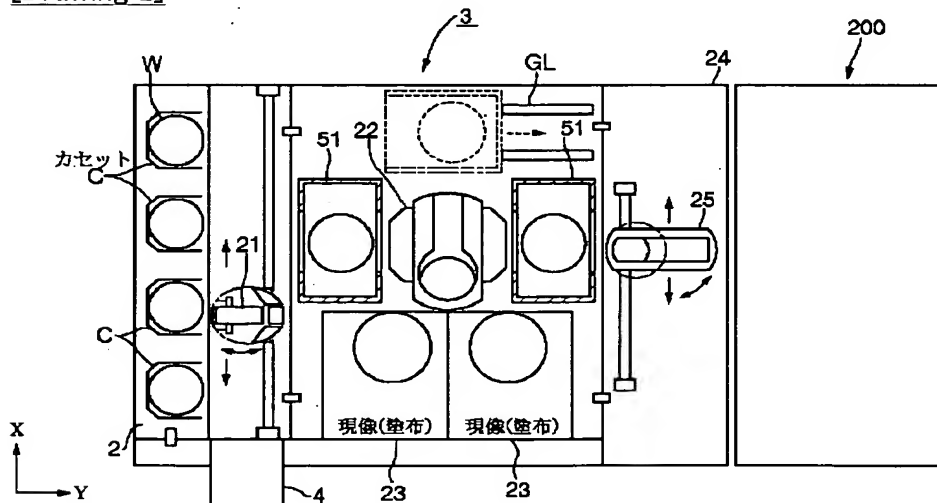
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## DRAWINGS

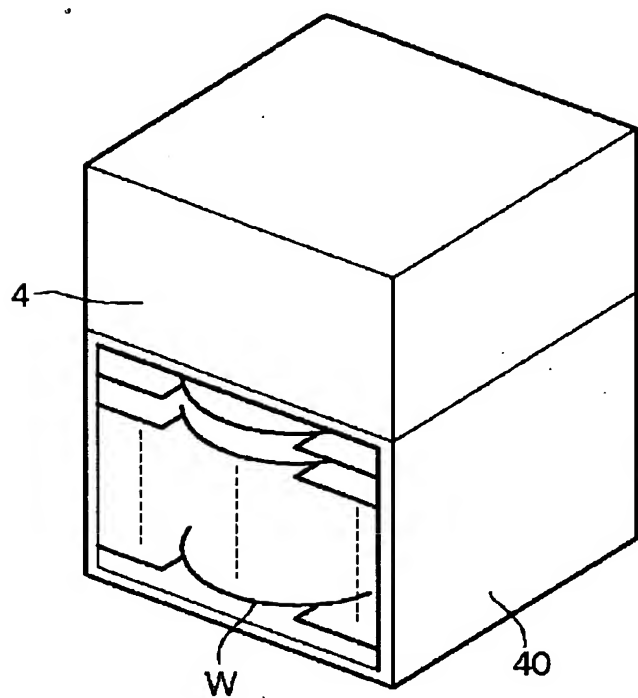
[Drawing 1]



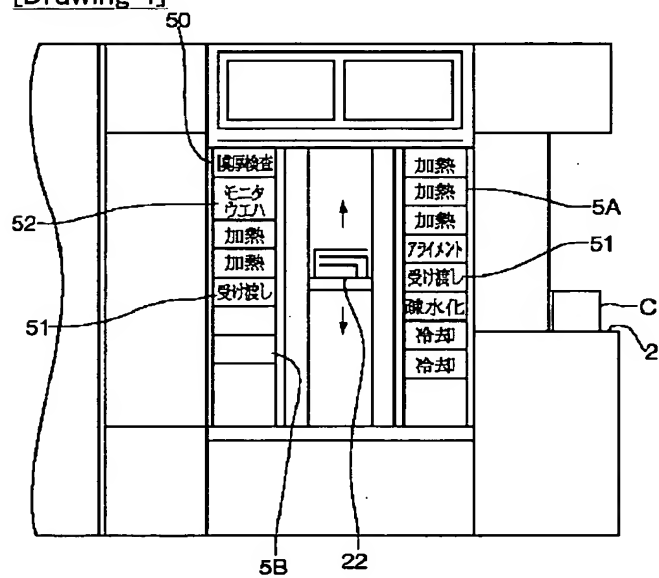
**[Drawing 2]**



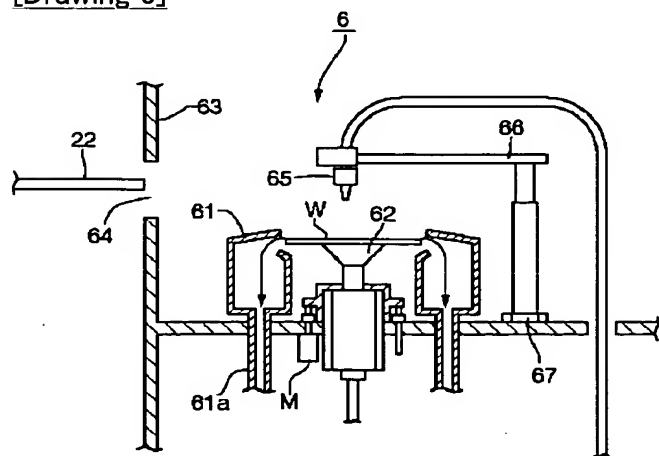
[Drawing 3]



[Drawing 4]

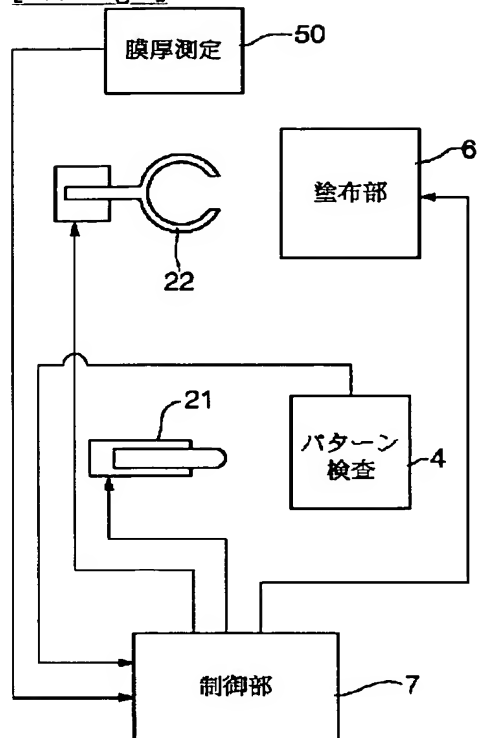


[Drawing 5]

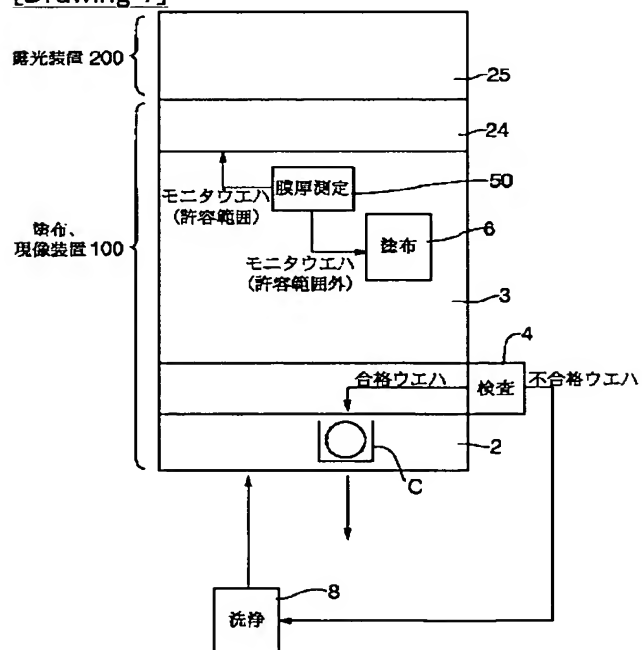




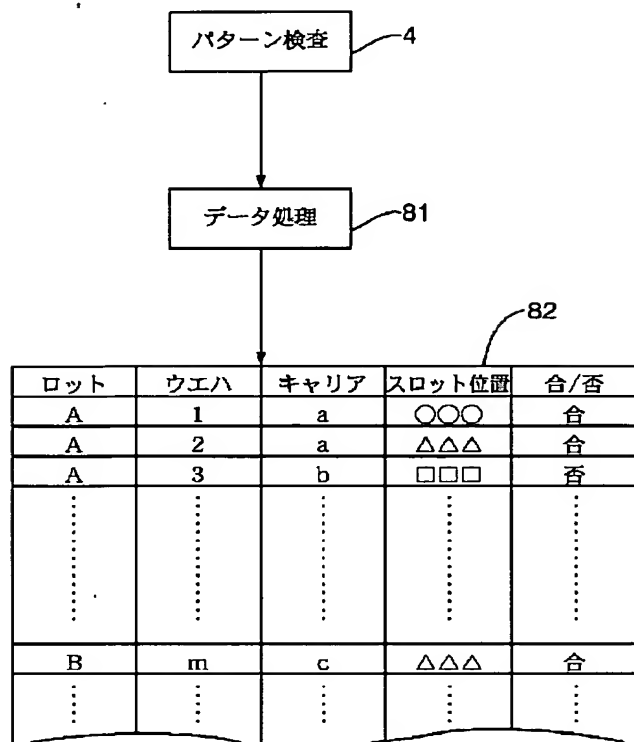
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Drawing 9]

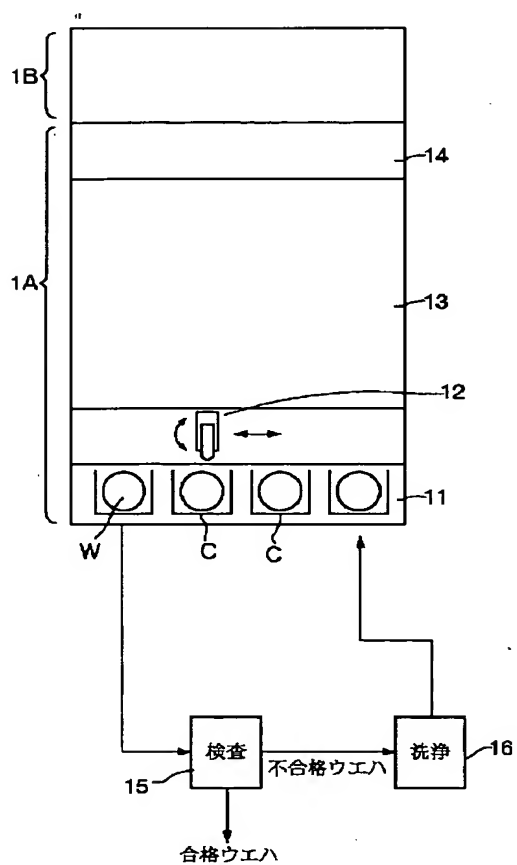
ロット	ウエハ	処理段階	再生
A	10	疎水化処理中	不要
⋮	⋮	⋮	⋮
A	15	レジスト塗布中	必要
⋮	⋮	⋮	⋮
B	20	レジスト塗布後加熱中	不要
⋮	⋮	⋮	⋮
B	25	露光後、加熱中	必要
⋮	⋮	⋮	⋮
B	28	現像中	必要
⋮	⋮	⋮	⋮
C	30	現像後、加熱	不要
⋮	⋮	⋮	⋮

83

制御部 84

第2のウエハ搬送部 22

[Drawing 10]



[Translation done.]

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G 0 3 F 7/16	5 0 2	G 0 3 F 7/16	5 0 2 2 H 0 9 6
	7/30 5 0 2		7/30 5 0 2 5 F 0 3 1
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(71)出願人 000219967

東京エレクトロン株式会社

東京都港区赤坂5丁目3番6号

(72)発明者 緒方 久仁恵

東京都港区赤坂五丁目3番6号 東京エレクトロン株式会社内

(74)代理人 100091513

弁理士 井上 俊夫 (外1名)

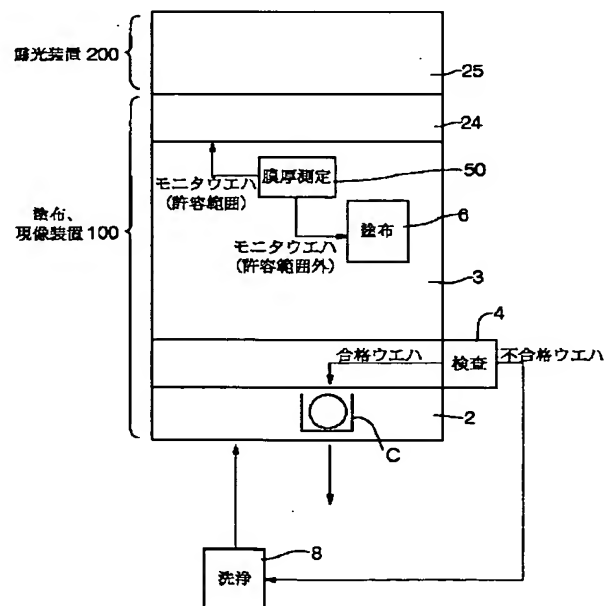
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(54)【発明の名称】 塗布、現像装置及び塗布現像処理における基板再生システム

## (57)【要約】

【課題】 塗布、現像装置を運転し、処理後の基板やモニタ基板の検査を行うにあたり、スループットの向上を図ること、自動化に対応できることを目的とする。

【解決手段】 キャリア搬入出部に置かれたキャリアに対してウエハの受け渡しを行うウエハ搬送部の搬送領域に、レジストパターンを検査するパターン検査部4と、検査の結果不合格となったウエハを収納するキャリア40とを設け、キャリア40を例えば装置の外部の洗浄部に運び、不合格ウエハのレジストを洗浄除去して再生し、再び装置内に搬入する。またモニタウエハのレジストの膜厚を、装置内に設けた膜厚測定部で測定し、その後溶剤ノズルを用いてシンナーで全面のレジストを除去して再生する。



## 【特許請求の範囲】

【請求項 1】 基板にレジストを塗布すると共に露光後の基板を現像し、露光装置に接続される塗布、現像装置において、

複数枚の基板が収納されたキャリアが搬入出されるキャリア搬入出部と、

このキャリア搬入出部に搬入されたキャリアから取り出された基板にレジストを塗布する塗布部と、

露光後の基板に対して現像を行う現像部と、

前記キャリア搬入出部、塗布部及び現像部の間で基板の搬送を行うための搬送手段と、

現像処理後の基板に形成されたレジストパターンを検査するパターン検査部と、このパターン検査部で不合格と判定された基板を合格と判定された基板から仕分ける仕分け手段と、を備えたことを特徴とする塗布、現像装置。

【請求項 2】 搬送手段は、前記キャリアと受け渡し位置との間で基板の搬送を行う第 1 の搬送部と、前記受け渡し位置、塗布部及び現像部の間で基板を搬送する第 2 の搬送部とからなり、パターン検査部は前記第 1 の搬送部の搬送領域内に設けられていることを特徴とする請求項 1 記載の塗布、現像装置。

【請求項 3】 仕分け手段は、不合格の基板を専用に収納する不合格用キャリアと前記搬送手段とを含み、搬送手段は、合格と判定された基板をキャリア搬入出部のキャリアに戻し、不合格と判定されたキャリアを前記不合格用キャリアに搬送することを特徴とする請求項 1 または 2 記載の塗布、現像装置。

【請求項 4】 仕分け手段は、不合格の基板に対してマーキングを行うマーキング手段であることを特徴とする請求項 1 または 2 記載の塗布、現像装置。

【請求項 5】 仕分け手段は、不合格の基板がいずれのキャリアのどの格納位置の基板かを記憶する記憶部であることを特徴とする請求項 1 または 2 記載の塗布、現像装置。

【請求項 6】 基板にレジストを塗布すると共に露光後の基板を現像し、露光装置に接続される塗布、現像装置において、

複数枚の基板が収納されたキャリアが搬入出されるキャリア搬入出部と、

このキャリア搬入出部に搬入されたキャリアから取り出された基板にレジストを塗布する塗布部と、露光後の基板に対して現像を行う現像部と、

前記キャリア搬入出部、塗布部及び現像部の間で基板の搬送を行うための搬送手段と、

モニタ基板を収納するモニタ基板収納部と、

このモニタ基板収納部から取り出されたモニタ基板のレジスト膜の膜厚を測定し、レジスト膜が適切な厚さであるか否かを判定する膜厚測定部と、を備えたことを特徴とする塗布、現像装置。

【請求項 7】 膜厚測定部で膜厚を測定したモニタ基板の表面全体のレジスト膜を、塗布部に設けられた溶剤ノズルからの溶剤により除去して基板を再生することを特徴とする請求項 6 記載の塗布、現像装置。

【請求項 8】 レジストの塗布処理及び現像処理に対する前処理及び／または後処理を行うための加熱部と、この加熱部で加熱された基板を冷却する冷却部とを設け、加熱部及び冷却部のうちの少なくとも一方を多段に配列して棚を構成し、この棚の一段を膜厚測定部として使用することを特徴とする請求項 6 または 7 記載の塗布、現像装置。

【請求項 9】 各基板の処理履歴を記憶する処理履歴記憶部と、装置の運転が停止して処理が中断したときに、前記処理履歴記憶部を参照して基板上のレジスト膜を除去することにより基板の再生を行う必要があるかないかを基板ごとに判定する手段と、を備えたことを特徴とする請求項 1 ないし 8 にいずれか記載の塗布、現像装置。

【請求項 10】 請求項 1 に記載された塗布、現像装置を用い、パターン検査部で不合格と判定された基板を洗浄部に搬送し、ここで基板を洗浄してレジスト膜を除去することにより基板を再生し、再生された基板を前記塗布、現像装置に戻して再びレジストパターンを形成することを特徴とする塗布、現像処理における基板再生システム。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、基板にレジスト膜を形成し、露光後の基板に対して現像を行い所望のパターンを形成する塗布、現像装置、及びこの装置で処理された基板の処理状態が良好でなかった場合にその基板を再生処理するシステムに関する。

## 【0002】

【従来の技術】半導体デバイスの製造プロセスにおいては、半導体ウエハなどの基板にレジスト液を塗布し、フォトリソマスクを用いてそのレジスト膜を露光し、それを現像することによって所望のパターンを有するレジストマスクを基板上に作製するフォトリソグラフィ技術が用いられている。

【0003】このフォトリソグラフィは、図 10 の概略図に示すように塗布現像装置 1 A に露光装置 1 B を接続したシステムによって行われる。塗布現像装置 1 A は、例えば半導体ウエハ（以下ウエハという）を処理する場合を例にとると、ウエハキャリア C を搬入出する搬入出部 1 1、この搬入出部 1 1 に載置されたキャリア C からウエハを取り出す受け渡しアーム 1 2 と、塗布、現像部 1 3 及びインターフェイス部 1 4 からなり、露光装置 1 B に接続される。受け渡しアーム 1 2 を介して塗布現像部 1 3 に搬入されたウエハ W は、レジスト膜が形成され、露光装置 1 B にて露光され、その後塗布、現像部 1 3 に戻されて現像処理され、受け渡しアーム 1 2 を介し

てキャリアCに戻される。

【0004】処理を終えたウエハWがキャリアCに収納されると、キャリアCはオペレータあるいは自動搬送ロボットによって搬入部11から搬出され、検査ユニット15に搬送される。この検査ユニット15では、ウエハW上に形成されたレジストパターンの線幅、レジストパターンと下地パターンとの重なり具合、レジストの塗布ムラ及び現像欠陥などについて検査を行う。そして合格と判定されたウエハWは次工程に送られるが、不合格と判定されたウエハWは洗浄ユニット16に送られる。ウエハW上に形成されるデバイスは多層構造をなしており、一つのデバイスを作成するのに塗布現像システムを数十回も通ることから、洗浄ユニット16では、各段階に応じた薬液を用い、その薬液中にウエハWを浸漬してレジストを溶解除去し、当該塗布、現像が行われる前の状態に戻す。そしてこのウエハWは再び塗布、現像システムに送られ、再度同様の処理が行われる。

【0005】また塗布、現像装置では、製品ウエハとは別にモニタウエハを用い、レジスト膜を形成した後、搬入部11からそのモニタウエハを搬出し、検査ユニット15にてレジスト膜の膜厚を検査し、レジスト液の塗布ユニットにおけるスピッチャックの回転数などの調整を行っている。膜厚の検査を終えたモニタウエハは、洗浄ユニット16にてレジスト膜を溶解除去し、リサイクルするようにしている。

#### 【0006】

【発明が解決しようとする課題】しかしながら、塗布、現像システムから搬出されたキャリアCを検査ユニット15に送り、ここでウエハWを1枚ずつ取り出して検査を行い、キャリアCに戻しているため、スループットの低下の一因となっている。またモニタウエハを用いてレジスト塗布ユニットを調整する場合、一旦塗布現像システムの外に取り出してレジスト膜の膜厚の検査を行い、更にそのレジスト膜をオペレータが手作業で洗浄除去して塗布、現像システムに戻しているため、オペレータが塗布、現像システムと外部の検査ユニットとの間を往來しなければならないし、モニタウエハの洗浄作業も行わなければならないことから、作業が面倒であるし、自動化も難しいという課題がある。

【0007】本発明は、このような事情の下になされたものでありその目的は、塗布、現像装置を運転し、処理後の基板やモニタ基板の検査を行うにあたり、スループットの向上を図れる技術を提供すること、及び自動化が容易な技術を提供することにある。

#### 【0008】

【課題を解決するための手段】請求項1の発明は基板にレジストを塗布すると共に露光後の基板を現像し、露光装置に接続される塗布、現像装置において、複数枚の基板が収納されたキャリアが搬入出されるキャリア搬入出部と、このキャリア搬入出部に搬入されたキャリアから

取り出された基板にレジストを塗布する塗布部と、露光後の基板に対して現像を行う現像部と、前記キャリア搬入出部、塗布部及び現像部の間で基板の搬送を行うための搬送手段と、現像処理後の基板に形成されたレジストパターンを検査するパターン検査部と、このパターン検査部で不合格と判定された基板を合格と判定された基板から仕分ける仕分け手段と、を備えたことを特徴とする。

【0009】この場合例えば搬送手段は、前記キャリアと受け渡し位置との間で基板の搬送を行う第1の搬送部と、前記受け渡し位置、塗布部及び現像部の間で基板を搬送する第2の搬送部とからなり、パターン検査部は前記第1の搬送部の搬送領域内に設けられている。

【0010】この発明によれば、塗布、現像装置内にパターン検査部を設け、かつ合格基板と不合格基板とを仕分けしているため、処理を終えた合格基板を速やかに次の工程に搬送することができる。またキャリア搬入出部におけるキャリアの搬出の待ち時間を消化しながらパターン検査を行うことができるので、装置の外部にパターン検査部を設けてキャリアの中から1枚ずつ基板を取り出して検査する場合に比べてスループットが高い。

【0011】具体的には仕分け手段は、不合格基板を専用で収納する不合格用キャリアと前記搬送手段とを含む構成とし、搬送手段は、合格と判定された基板をキャリア搬入出部のキャリアに戻し、不合格と判定されたキャリアを前記不合格用キャリアに搬送するようにしてもよい。このようにすればキャリア搬入出部から搬出されるキャリア内には不合格基板は含まれないのでより一層高いスループットを得ることができる。

【0012】また仕分け手段は、不合格の基板に対してマーキングを行うマーキング手段であってもよいし、あるいは不合格の基板がいずれのキャリアのどの格納位置の基板かを記憶する記憶部であってもよい。

【0013】請求項6の発明は、基板にレジストを塗布すると共に露光後の基板を現像し、露光装置に接続される塗布、現像装置において、複数枚の基板が収納されたキャリアが搬入出されるキャリア搬入出部と、このキャリア搬入出部に搬入されたキャリアから取り出された基板にレジストを塗布する塗布部と、露光後の基板に対して現像を行う現像部と、前記キャリア搬入出部、塗布部及び現像部の間で基板の搬送を行うための搬送手段と、モニタ基板を収納するモニタ基板収納部と、このモニタ基板収納部から取り出されたモニタ基板のレジスト膜の膜厚を測定し、レジスト膜が適切な厚さであるか否かを判定する膜厚測定部と、を備えたことを特徴とする。

【0014】この発明によれば、モニタウエハの膜厚測定を塗布、現像装置内で行うためメンテナンスを効率よく行うことができる。この場合膜厚測定部で膜厚が測定されたモニタ基板の表面全体のレジスト膜を、塗布部に設けられた溶剤ノズルからの溶剤により除去して基板を

再生することが好ましく、このようにすればモニタ基板の処理を自動で行うことができる。

【0015】また塗布、現像装置には通常レジストの塗布処理及び現像処理に対する前処理及び／または後処理を行うための加熱部と、この加熱部で加熱された基板を冷却する冷却部とが設けられており、加熱部及び冷却部のうちの少なくとも一方を多段に配列して棚を構成し、この棚の一段を膜厚測定部として使用してもよい。

【0016】以上において本発明は、各基板の処理履歴を記憶する処理履歴記憶部と、装置の運転が停止して処理が中断したときに、前記処理履歴記憶部を参照して基板上のレジスト膜を除去することにより基板の再生を行う必要があるかないかを基板ごとに判定する手段と、を備えた構成としてもよい。このようにすれば装置がダウンしたときに一律に基板の再生を行うことなく、再生が必要な基板だけ処理すればよいので無駄な処理を行わなくて済む。

【0017】また本発明は、請求項1に記載された塗布、現像装置を用い、パターン検査部で不合格と判定された基板を洗浄ユニットに搬送し、ここで基板を洗浄してレジスト膜を除去することにより基板を再生し、再生された基板を前記塗布、現像装置に戻して再びレジストパターンを形成する基板再生システムとしても成り立つものである。

#### 【0018】

【発明の実施の形態】図1は、本発明の実施の形態に係る塗布、現像装置100を露光装置200に接続してなる塗布、現像システムの全体の概略を示す斜視図、図2はこのシステムの内部を示す平面図である。塗布、現像装置100は、複数枚例えば25枚の基板であるウエハWが棚状に保持された搬送容器をなすウエハキャリア（以下単に「キャリア」という）Cが搬入出されるキャリア搬入出部2と、ウエハWに対して塗布、現像処理を行うための処理部3と、この処理部3と前記キャリア搬入出部2との間でウエハWの受け渡しを行う第1のウエハ搬送部21と、を備えている。

【0019】前記キャリア搬入出部2は、例えば4個のキャリアCを載置するステージとして構成されている。第1のウエハ搬送部21は、X、Y、Z方向に移動自在でかつ鉛直軸回りに回転自在な基台に進退自在なアームを設けて構成されている。この第1のウエハ搬送部21の搬送領域、例えば塗布、現像装置本体の側部には、現像処理後のウエハWに形成されたレジストパターンを検査するパターン検査部4が設けられている。このパターン検査部4は、レジストパターンの線幅、レジストパターンと下地膜との重なり具合、現像欠陥及びレジストの塗布ムラについて検査を行うためのものであり、例えば3CCDカメラで得られたウエハの画像をパーソナルコンピュータにて解析することによって検査を行うことができる。

【0020】また前記第1のウエハ搬送部21の搬送領域であって、パターン検査部4の下方側には、このパターン検査部4で不合格と判定されたウエハWを収納するためのキャリア40が載置台40aの上に置かれている。なおこのキャリア40は前記キャリアCと同様のものである。図3は、パターン検査部4とキャリア40とを示す斜視図である。前記第1のウエハ搬送部21及びキャリア40とは、この例では、不合格と判定されたウエハWを合格と判定されたウエハWから仕分ける仕分け手段をなしている。

【0021】処理部3は、中央にメイン搬送アームなどと呼ばれている第2のウエハ搬送部22が設けられており、この第2のウエハ搬送部22の前後（キャリア搬入出部2から奥を見たときの方向で表わしている。）には、夫々棚5A、5Bが設けられている。これら棚5A、5Bは、複数のユニットが積み上げられて構成されており、図4に示すようにそれらユニットに対してウエハを加熱する加熱ユニット、ウエハの位置合わせをするためのアライメントユニットなどが割り当てられ、更にユニット群の一つがウエハの受け渡しユニット51として割り当てられている。なお図4に示すユニットの割り当てはイメージを示す便宜上のもので、この割り当てに拘束されるものではなく、例えば加熱ユニットと冷却ユニットを別々の棚に分けてもよい。なお図2に示すようにガイドレールGLに沿ってスライドできるように前記棚5A、5Bと同様な棚5Cを設けてもよい。

【0022】図4に示すように前記棚5B（あるいは5A、5C）の例えば最上段には、膜厚測定部50が設けられていると共に、その下の段には、複数枚のモニタウエハを収納するためのモニタウエハ収納部52が設けられている。モニタウエハは、後述する塗布部に係るパラメータなどを定期的にチェックするために、製品ウエハと同様の処理が行われる検査専用のウエハであり、膜厚測定部50は、このモニタウエハに形成されたレジスト膜の膜厚を検査するものである。膜厚測定部50は、例えば落射照明型顕微鏡、分光器及びデータ処理部を含む光干渉式膜厚計により構成される。この光干渉式膜厚計においては、光源から対物レンズを経てウエハに照射され、ここで反射された光を分光器に入射し、ここに入射された反射スペクトルをコンピュータで解析することにより膜厚が算出される。

【0023】前記第2のウエハ搬送部22の右側には、上段側に2個の現像部23が設けられ、下段側に2個の塗布部6が設けられている。前記第2のウエハ搬送部22は昇降自在、鉛直軸まわりに回転自在、進退自在に構成されており、ウエハWを棚5A～5Cの各ユニット、塗布部6及び現像部23の間で受け渡し役割をもっている。なおこの例では、第1のウエハ搬送部21及び第2のウエハ搬送部22により、ウエハ搬送手段を構成している。

【0024】塗布部6及び現像部23はほとんど同様の構成であり、塗布部6の構造について図5を参照しながら簡単に説明する。図5中61は排気路61aが形成されたカップであり、この中にスピチャック62が設けられている。このスピチャック62は、ケース63の受け渡し口64を介して第2のウエハ搬送部22により搬入されたウエハWを受け取ることができるように、モータMにより昇降できる構成となっている。カップ61の上方には、ノズルが設けられている。ノズルにはレジストを供給するレジストノズルと溶剤例えばシンナーを供給する溶剤ノズルとがある。図5では溶剤ノズルを65として示してある。溶剤ノズル65はレジストを塗布する前に濡れをよくするためにウエハW上にシンナーを供給するためのものである。溶剤ノズル65は、支持アーム66に支持され、レール67に案内されて水平に（紙面の表裏方向）に移動する。レジストノズルについても同様に移動できるように構成されている。レジストの塗布については、スピチャック62により回転しているウエハWの中心部にレジストノズルからレジストを供給し、遠心力により引き伸ばして塗布される。

【0025】また塗布、現像装置100は、インターフェイス部24を備えており、処理部3はこのインターフェイス部24を介して露光装置200に接続されている。このインターフェイス部24は、前記棚5Bの受け渡しユニット51と露光装置200との間をウエハWを搬送するための搬送アーム25を備えている。

【0026】ここでウエハWのパターン検査及び膜厚測定の結果とその後のウエハWの搬送制御との関係について図6を参照しながら述べる。現像処理を終えたウエハWはパターン検査部4に搬送され、ここで既述のように検査が行われるが、検査結果が合格であるウエハWについてはキャリア搬入部2に載置されているキャリアCに搬送され、検査結果が不合格であるウエハWについてはキャリア40に搬送されるように、制御部7により第1のウエハ搬送部21が制御される。また膜厚測定部50にて検査されたモニタウエハは、塗布部6に戻されるように、制御部7により第2のウエハ搬送部22が制御される。塗布部6は、後述のようにシンナーによりウエハ全面のレジストを溶解洗浄するように動作する。これら一連の制御は、制御部7に格納されたプログラムにより実行される。

【0027】以上のように塗布、現像装置100は構成されているが、図7に示すようにこの装置の外部には、パターン検査部4における検査結果が不合格となったウエハWを薬液により洗浄してウエハW全面のパターンを除去する洗浄部8が設けられている。前記塗布、現像装置100及び洗浄部8からなるシステムは、本発明の基板再生システムの実施の形態に相当する。

【0028】次いで上述実施の形態の作用について述べる。先ず外部からキャリアCがキャリア搬入部2に搬

入され、第1のウエハ搬送部21によりこのキャリアC内からウエハWが取り出される。ウエハWは、第1のウエハ搬送部21から棚5Aの受け渡しユニット51を介して第2のウエハ搬送部22に受け渡され、更に棚5A（あるいは5B、5C）の処理ユニットに順次搬送されて、所定の処理例えば疎水化処理、冷却処理などが行われる。続いてこのウエハWは塗布部6にてレジストが塗布され、更に加熱処理された後、棚5Bの受け渡しユニット51からインターフェイス部24を経て露光装置200に送られる。

【0029】露光装置200にて露光されたウエハWは、逆の経路で処理部3に戻され、第2のウエハ搬送部22により現像部23に搬送され、現像処理される。なお詳しくは、ウエハWは、現像処理の前に加熱処理及び冷却処理される。現像処理されたウエハWは上述と逆の経路で第1のウエハ搬送部21に受け渡され、その後パターン検査部4に搬入されて、パターンの線幅、パターンと下地膜との重なり具合、現像ムラ及び現像欠陥が検査される。

【0030】図7に示すようにパターン検査結果が合格であるウエハWは第1のウエハ搬送部21により、キャリア搬入部2に載置されている元のキャリアCに戻され、パターン検査結果が不合格であるウエハWは第1のウエハ搬送部21により、パターン検査部4の下方側にあるキャリア40に収納される。即ちパターン検査の不合格品が第1のウエハ搬送部21及びキャリア40によって、合格品から仕分けられたことになる。

【0031】キャリアCは次ぎのステーションに搬送され、キャリア40は例えばオペレータにより洗浄部8に搬送される。洗浄部8では複数種の薬液槽が用意され、ウエハW上のパターンをなすレジストの種類に応じた薬液槽に当該ウエハWが浸され、ウエハW全面のレジストを溶解除去して、塗布、現像装置100に搬入される前の状態に戻す、つまりウエハWを再生する。再生されたウエハWは、例えばキャリアに収納されてオペレータにより塗布、現像装置100のキャリア搬入部2に搬入されて、再度塗布、露光、現像処理が行われる。

【0032】ここで例えば定期的に塗布、現像システムにおける各処理例えばスピチャック62の回転数などのチェックをするために棚5Bのモニタウエハ収納部52からモニタウエハを第2のウエハ搬送部22により取り出し、塗布部6に搬送してレジストを塗布し、棚5Bの膜厚測定部50に搬送する。モニタウエハは膜厚測定部50で膜厚が測定され、塗布部6に搬送され、スピチャック62に吸着されて回転しながら、溶剤ノズル65から溶剤であるシンナーが供給され、モニタウエハの全面のレジストが溶解除去されて再生され、その後モニタウエハ収納部50に戻される。なおモニタウエハについても製品ウエハと同様に露光、現像処理を行い、パターン検査部4にてパターンを検査するようにしてもよ



い。

【0033】このような実施の形態によれば次ぎのような効果がある。塗布、現像装置100内にパターン検査部4を設け、現像処理されたウエハWをキャリア搬入部2に搬送する途中でパターンの検査を行い、検査に合格したウエハと不合格のウエハとを仕分けしているため、合格ウエハはそのままキャリアCにより次工程に搬送することができ、塗布、現像装置の外部でキャリアC内から1枚ずつ取り出してパターンの検査を行っていた場合に比べて高いスループットが得られる。

【0034】またモニタウエハの膜厚を塗布、現像装置内で測定すると共に、モニタウエハに形成されたレジスト膜を塗布部6の溶剤ノズルからのシンナーを用いて除去し再生するようにしているため、自動化を図ることができ、効率のよい処理を行うことができる。この場合モニタウエハは下地にパターンが形成されていないベアウエハが用いられるので、溶剤ノズルからのシンナーの供給とウエハの回転とにより、確実にレジストを除去することができる。更に例えば棚5Bの一部に膜厚測定部50及びモニタウエハは収納部52を配置するようにすれば、平面的なスペースを格別確保しなくてよいので、装置の大型化を抑えることができる。

【0035】以上において本発明は、洗浄部8を塗布、現像装置100に設けてもよく、例えば第1のウエハ搬送部21の搬送領域であって、キャリア搬入部2から装置の奥側に向かって左側（パターン検査部4と反対側）に設けるようにしてもよい。このようにすれば製品ウエハの再生処理を自動化することができる。

【0036】またパターン検査の合格ウエハを不合格ウエハから仕分ける手法としては、パターン検査部4内にマーキング手段を設け、不合格ウエハに対しては周縁部にマーキング手段からインクを滴下してマーキングするようにしてもよいし、図8に示すように検査結果をデータ処理部81を介して記憶部82に格納するようにしてもよい。記憶部82では、例えばウエハの識別コード、そのウエハが属するロットの識別コード、ウエハが運ばれてきたキャリアCの識別コード、そのキャリアCにおける収納位置（スロット位置）及びパターン検査の結果を対応づけて格納している。従ってキャリアCを搬出した後、例えば洗浄部あるいは次のステーションにて制御系側でこの記憶部82のデータを参照することにより合格ウエハと不合格ウエハとを判別することができ、合格ウエハに対して速やかに次の工程を行うことができる。これらの例では、前記マーキング手段及び記憶部82は、仕分け手段に相当する。

【0037】更に塗布、現像装置の運転がトラブルにより停止して処理が中断した場合に、処理工程の途中のウエハに対して再生処理を行うが、この場合の好ましい手法について図9を参照しながら説明する。制御部84により各ウエハWの処理履歴を取り込み、ウエハWと処理

履歴とを対応付けて記憶部83に記憶する。この例では、ウエハWの属するロットの識別コードも対応付けて記憶されている。処理履歴とは、例えばウエハが疎水化処理中、レジスト塗布後の加熱処理中、露光後現像前の加熱処理中、現像後の加熱処理中などである。そして制御部84は、システムがダウンして処理が中断した場合、記憶部83内の処理履歴を参照して各ウエハがレジストを除去して再生する必要があるかそれともそのまま処理を続行することができるかを判断してその結果を記憶部83に書き込み（この書き込みはシステムがダウンする前に行ってもよい）、この結果に基づいて第2のウエハ搬送部22を操作し、再生が必要なウエハWについては不合格用キャリア40に搬送する。また再生の必要のないウエハWについては、そのまま処理が続行される。

【0038】例えば化学増幅型のレジストを用いた場合、露光後の加熱処理の時間の管理が厳しく、ある時間以上加熱されると予定している現像ができなくなるため、この加熱処理中のウエハについては再生処理が必要になる。これに対して現像後の加熱処理では、時間が長くて特に問題がないことから、その段階のウエハWに対しては処理を続行すればよく、再生の必要がない。従ってこのように処理履歴を管理すれば、一律にウエハWを再生しなくてよいので、処理を無駄にすることなくかつ不要な再生処理を行わなくて済む。

【0039】なお基板としてはウエハに限らず液晶ディスプレイ用のガラス基板であってもよい。

【0040】

【発明の効果】以上のように本発明によれば、塗布、現像装置にパターン検査部や膜厚測定部を設けているため、処理後の基板の検査を行うにあたり、スループットの向上を図ることができる。また塗布、現像装置内に洗浄部を設けたり、あるいは塗布部の溶剤ノズルを利用してレジストを除去することにより、自動化への対応が容易になる。

【図面の簡単な説明】

【図1】本発明の実施の形態に係る塗布、現像装置と露光装置とを組み合わせたシステムを示す概観斜視図である。

【図2】上記システムの内部を示す平面図である。

【図3】本発明の実施の形態に用いられるパターン現像装置、及び不合格ウエハを収納するためのキャリアを示す斜視図である。

【図4】上記システムの内部を示す側面図である。

【図5】塗布部を示す縦断面図である。

【図6】第1のウエハ搬送部及び第2のウエハ搬送部の制御系を示す説明図である。

【図7】本発明の実施の形態に係る、塗布、現像処理における基板再生システムを示す説明図である。

【図8】パターン検査の結果が合格であるウエハと不合

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格であるウエハとを仕分ける手法の一例を示す説明図である。

【図9】本発明で用いられる、処理履歴のための記憶部のデータを概念的に示すと共にその記憶部を含めた制御系を示す説明図である。

【図10】従来の塗布、現像処理における基板再生システムを示す説明図である。

【符号の説明】

100 塗布、現像装置

200 露光装置

2 キャリア搬入部

21 第1のウエハ搬送部

\* 22 第2のウエハ搬送部

23 現像部

3 処理部

4 パターン検査部

40 不合格用キャリア

50 膜厚測定部

52 モニタウエハ収納部

6 塗布部

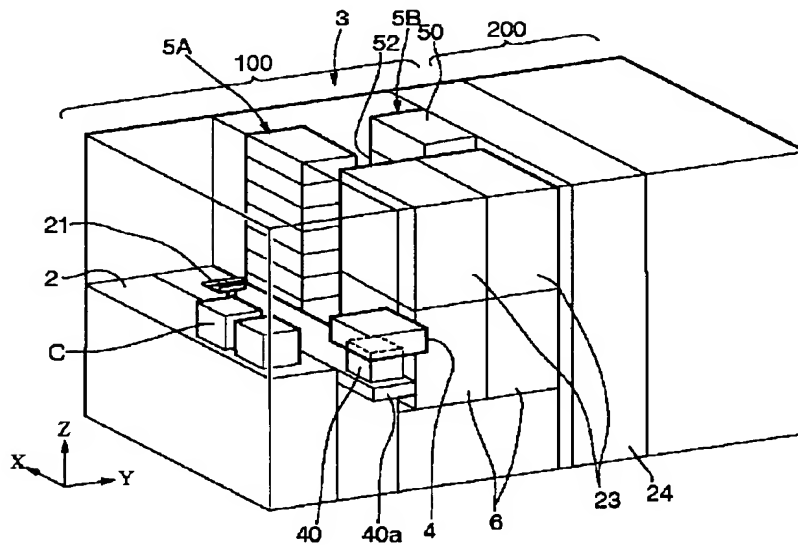
65 溶剤ノズル

10 7 制御部

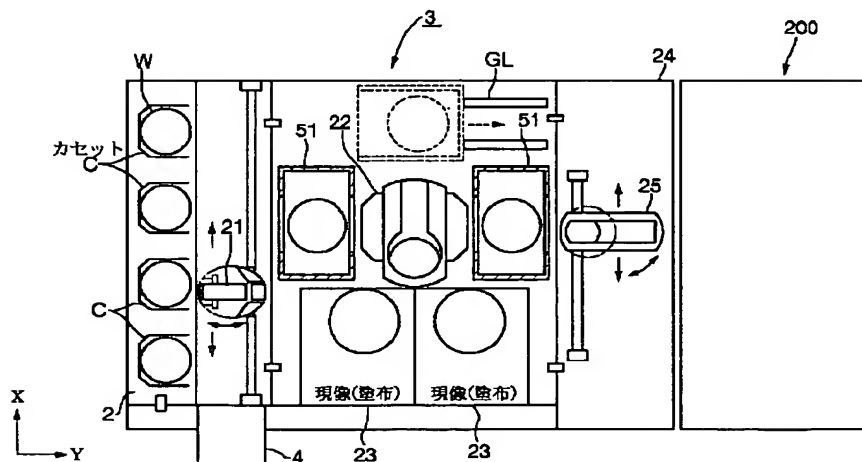
8 洗浄部

\* 82, 83 記憶部

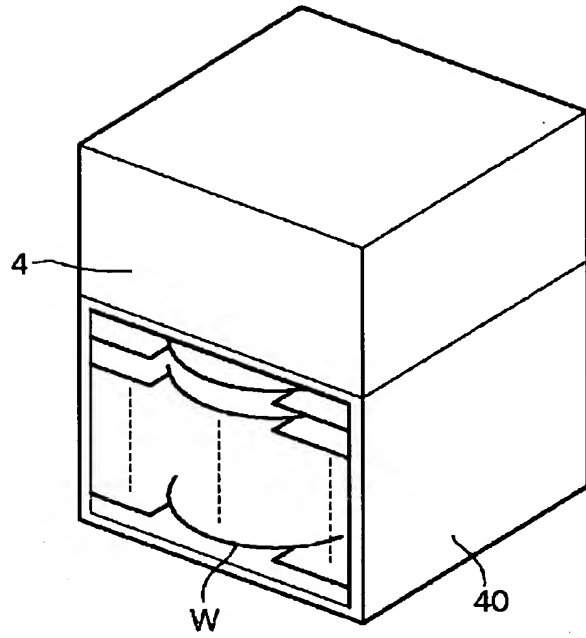
【図1】



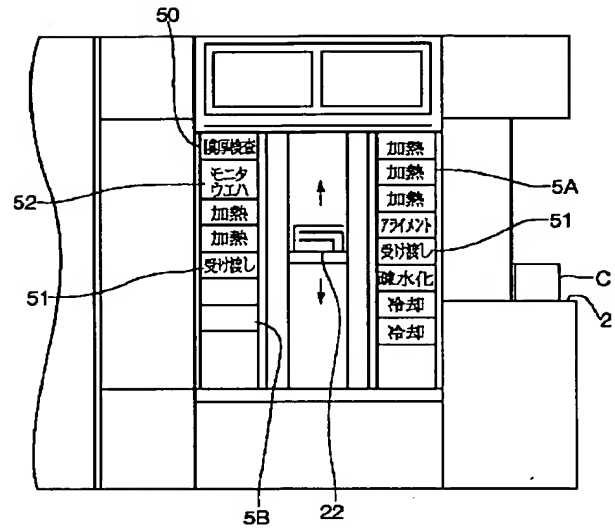
【図2】



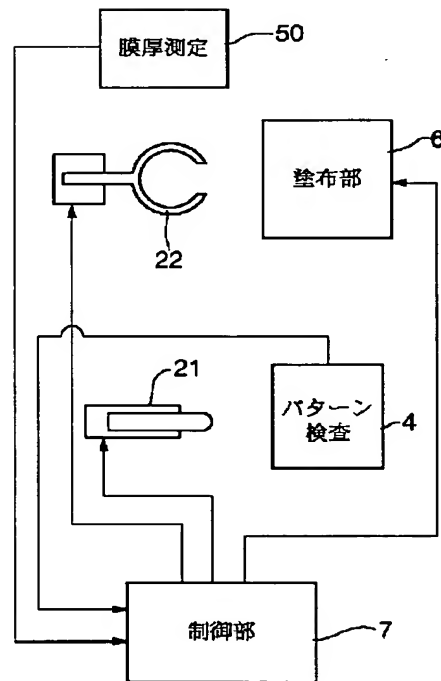
【図3】



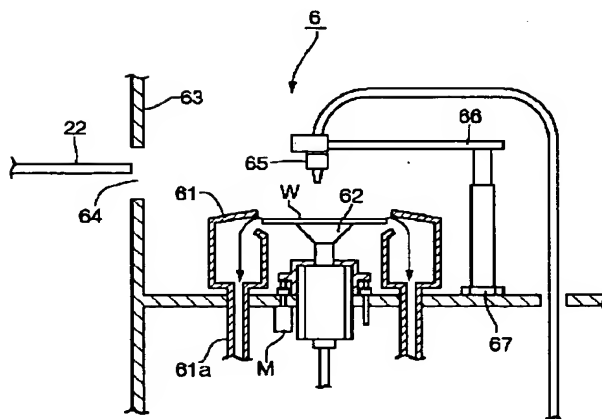
【図4】



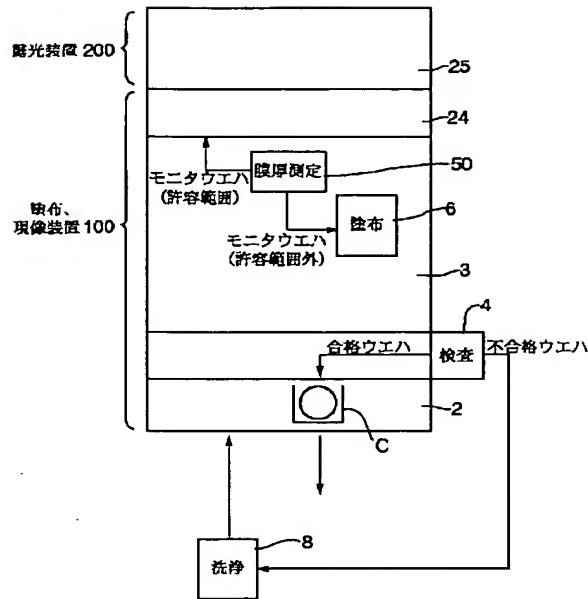
【図6】



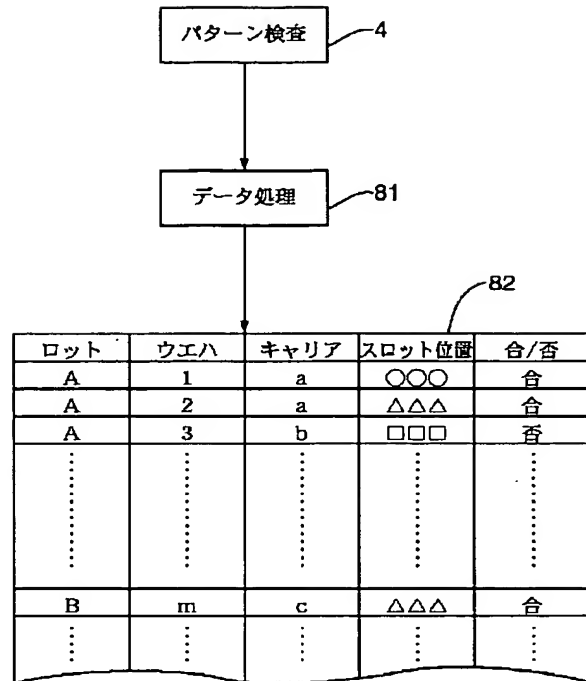
【図5】



【図7】

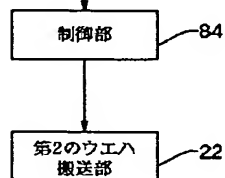


【図8】

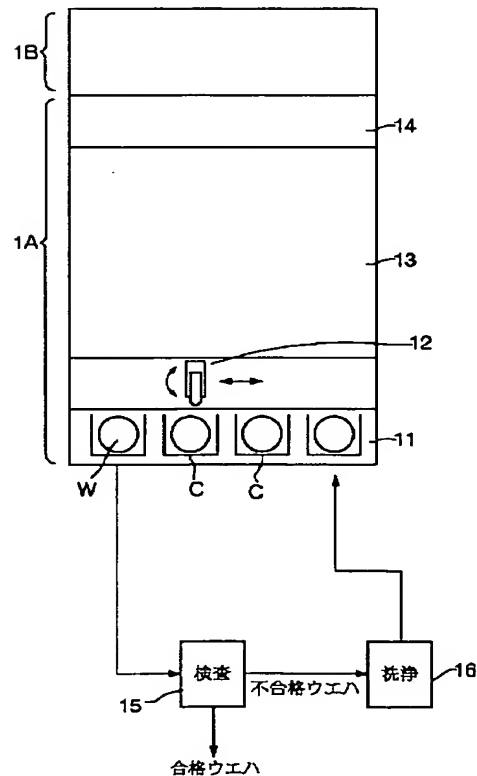


【図9】

ロット	ウエハ	処理段階	再生
A	10	酸水処理中	不要
...	...	...	...
A	15	レジスト塗布中	必要
...	...	...	...
B	20	レジスト塗布後加熱中	不要
...	...	...	...
B	25	露光後、加熱中	必要
...	...	...	...
B	28	現像中	必要
...	...	...	...
C	30	現像後、加熱	不要
...	...	...	...



【図10】



## フロントページの続き

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MA33  
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JA21 JA22 LA18 LA19